

2nd AMENDED CLAIMS

1. (Amended) An adjustment method for a projection optical system which projects an image of a pattern on a first surface onto a second surface, characterized by comprising:

changing at least one condition of illumination condition for illuminating the pattern on the first surface and structural condition of the pattern in various ways;

changing a wavelength of illumination light for illuminating the pattern on the first surface for each condition, and detecting a change amount of image formation characteristics of an image projected onto the second surface via the projection optical system; and

determining a predetermined relationship between a change amount of installation environment of the projection optical system and the change amount of the image formation characteristics for each condition based on a result of the detection.

2. The adjustment method for a projection optical system according to Claim 1, characterized in that when the installation environment of the projection optical system changes, the image formation characteristics of the projection optical system is adjusted based on the predetermined relationship.

3. (Amended) The adjustment method for a projection optical system according to Claim 2, characterized in that the image formation characteristics of the projection optical system are adjusted by changing the wavelength of the illumination light based on the predetermined relationship.

4. An adjustment method for a projection optical system which projects an image of a pattern on a first surface onto a second surface, characterized in that:

when installation environment is different between an assembly location where the projection optical system is assembled and adjusted and a relocated location where the projection optical system is used, the wavelength of the illumination light for illuminating the pattern on the first surface is changed according to the installation environment of the relocated location in advance when assembling and adjusting the projection optical system at the assembly location.

5. (Amended) The adjustment method for a projection optical system according to Claims 2, 3 or 4, characterized in that gas whose barometric pressure changes in association with the atmospheric pressure is supplied inside the projection optical system, and the change of the installation environment of the projection optical system is the change of the atmospheric pressure.

6. The adjustment method for a projection optical system according to Claim 1, characterized in that the predetermined relationship is determined based on the first relationship between the change amount of the installation environment and the change amount of the wavelength, and the second relationship between the change amount of the wavelength and the change amount of the image formation characteristics.

7. The adjustment method for a projection optical system according to Claim 6, characterized in that the first relationship is determined based on the refractive index characteristics of the glass material of the projection optical system and the refractive index characteristics of gas around the projection optical system.

8. The adjustment method for a projection optical system according to Claim 7, characterized in that the projection optical system is comprised of a plurality of types of glass materials, and the first relationship is determined by equalizing the relationship between the change amount of the installation environment and the change amount of the wavelength determined for each one of the plurality of types of glass materials.

9. (Deleted)

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10. The adjustment method for a projection optical system according to Claim 1, characterized in that the change amount of the image formation characteristics due to the change of the wavelength of the illumination light is detected in a state where the installation environment of the projection optical system is maintained to be constant.

11. The adjustment method for a projection optical system according to Claim 4, characterized in that the wavelength of the illumination light when the projection optical system is used in the relocated location is set to a wavelength according to the installation environment of the assembly location.

12. (Amended) An exposure method for illuminating a pattern formed on a first surface by an illumination light and projecting an image of the pattern onto a second surface via a projection optical system, characterized by comprising:

a first step of determining information on a change amount of predetermined image formation characteristics of the projection optical system; and

a second step of correcting the change amount of the predetermined image formation characteristics using a first technique for adjusting the predetermined image formation characteristics by changing a wavelength of the illumination

light and a second technique for adjusting the predetermined image formation characteristics using a method different from the first technique.

13. (Amended) The exposure method according to Claim 12, characterized in that in the first step, the change amount of the predetermined image formation characteristics is determined based on the result of measurement of the installation environment of the projection optical system.

14. (Amended) The exposure method according to Claim 13, characterized in that the change amount of the installation environment is the difference between the measured environment and a predetermined reference environment.

15. (Amended) The exposure method according to Claim 12, characterized in that the second technique is the adjustment of the projection optical system.

16. The exposure method according to Claim 15, characterized in that the adjustment of the projection optical system is performed by a first adjustment for moving at least one lens of the projection optical system in the optical axis direction of the projection optical system or inclining the lens with respect to the optical axis, or by a second adjustment for controlling

the barometric pressure in a space sealed between a predetermined part of lenses of the projection optical system.

17. (Amended) The exposure method according to Claim 12, characterized in that in the first step, the change amount of the predetermined image formation characteristics caused by a factor other than the installation environment of the projection optical system is determined.

18. (Amended) The exposure method according to Claim 17, characterized in that the change amount of the predetermined image formation characteristics caused by a factor other than the installation environment includes the fluctuation of the predetermined image formation characteristics due to the irradiation of the illumination light.

19. (Amended) The exposure method according to Claim 12, characterized in that the projection optical system is comprised of a plurality of types of glass materials.

20. (Amended) The exposure method according to Claim 19, characterized in that in the second step, the residue of the change amount of the predetermined image formation characteristics which the first technique could not completely correct is corrected by the second technique after executing the first

technique.

21. (Amended) The exposure method according to Claim 13, characterized in that when the change amount of the installation environment is a predetermined value or more, the change amount of the predetermined image formation characteristics is corrected using the first technique in the second step.

22. (Amended) An exposure method using a projection exposure apparatus for illuminating a pattern formed on a first surface by an illumination light and projecting an image of the pattern onto a second surface via a projection optical system, characterized by comprising:

measuring an installation environment of the projection optical system to determine a change amount of the installation environment, and

changing a wavelength of the illumination light according to the change amount of the installation environment when the projection exposure apparatus is executing a predetermined preparation operation for projecting the image of the pattern onto the second surface.

23. (Amended) The exposure method according to Claim 22, characterized in that the predetermined preparation operation includes at least one operation among operations of setting a

mask on which the pattern is formed at a predetermined position for exposure in the projection exposure apparatus; of setting a substrate onto which the image of the pattern is projected at a predetermined exposure position in the projection exposure apparatus, and of specifying the illumination area of the illumination light on the mask.

24. (Amended) A device manufacturing method comprising transferring the device pattern onto a work piece using the exposure method according to any one of Claims 12 to 23.

25. (Amended) A projection exposure apparatus comprising an illumination optical system which illuminates a mask pattern by an illumination light, and a projection optical system which projects the image of the mask pattern onto a substrate, characterized by comprising:

a wavelength adjusting device which changes a wavelength of the illumination light;

an image formation characteristics measurement system which measures a change amount of image formation characteristics of the projection optical system;

a control system which changes at least one condition of illumination condition for illuminating the mask pattern and structural condition of the mask pattern in various ways, controls the formation characteristics measurement system to

measure a change amount of the image formation characteristics while changing the wavelength by the wavelength adjusting device for each condition, and determines a predetermined relationship between a change amount of the installation environment of the projection optical system and the change amount of the image formation characteristics based on the measurement results for the each condition; and

a memory which stores the predetermined relationship which were determined by the control system for the each condition.

26 (Amended) A projection exposure apparatus comprising an illumination optical system which illuminates a mask pattern by an illumination light, and a projection optical system which projects the image of the mask pattern onto a substrate, characterized by further comprising:

measurement means for determining information on a change amount of predetermined image formation characteristics of the projection optical system;

a first image formation characteristics adjustment system which adjusts the predetermined image formation characteristics by a first technique for changing a wavelength of the illumination light; and

a second image formation characteristics adjustment system which adjusts the predetermined image formation characteristics by a second technique which is different from the first technique.

27. (Amended) The projection exposure apparatus according to Claim 26, characterized in that the second image formation characteristics adjustment system adjusts the image formation characteristics by adjusting the projection optical system.

28. (Amended) The projection exposure apparatus according to Claim 27, characterized in that the projection optical system is comprised of a plurality of types of glass materials.

29. (Added) The projection exposure apparatus according to Claim 28, characterized in that the second image formation characteristics adjustment system adjusts the residue of the change amount of the predetermined image formation characteristics which the first image formation characteristics adjustment system could not correct.

30. (Added) The projection exposure apparatus according to one of Claims 26 to 29, characterized in that the measurement means determines the change amount of the installation of the projection optical system as the information, and when the change amount of the installation environment is a predetermined value or more, the predetermined image formation characteristics are adjusted using the first image formation characteristics adjustment system.

31. (Added) A projection exposure apparatus comprising an illumination optical system which illuminates a mask pattern by an illumination light, and a projection optical system which projects the image of the mask pattern onto a substrate, characterized by further comprising:

a wavelength adjusting device which changes a wavelength of the illumination light;

an installation environment measurement system which measures the installation environment of the projection optical system and determines a change amount of the installation environment; and

a certain device which executes a predetermined preparation operation for projecting the image of the pattern onto the substrate;

wherein the wavelength adjusting device changes the wavelength of the illumination light according to the change amount of the installation environment when the certain device is executing the predetermined preparation operation.

32. (Added) The projection exposure apparatus according to Claim 31, characterized in that the predetermined preparation operation includes at least one operation of the operations of setting the mask on which the pattern is formed at a predetermined position for exposure in the projection exposure apparatus, an

operation for setting the substrate onto which the image of the pattern is projected at a predetermined exposure position in the projection exposure apparatus, and an operation for specifying an illumination area of the illumination light on the mask.

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